

# CSF Leaks

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## ETIOLOGY

CSF leaks occur if *dura is violated*:

- surgery** (esp. if CSF is contaminated with blood, bone dust, and necrotic debris → inflammatory & mechanical interference at arachnoid villi → CSF pressure↑).
- tumor invasion** (e.g. pituitary tumor erosion)
- trauma** (esp. basal skull fractures – thin & tightly adherent dura).
  - fracture of **ethmoid** or **sphenoid** bone or orbital plate of **frontal** bone → **rhinorrhea (nasoliquorrhea)** - CSF leak through cribriform plate or adjacent sinus.
  - fracture of **temporal** bone → **otorrhea (otoliquorrhea)**.

Predisposing factor - ICP↑.

## CLINICAL FEATURES

- **watery discharge** from nose, ear canal, wound.
  - starts within 48 hours after dural breach.
    - N.B. after TBI, nasal mucosa may be swollen – rhinorrhea is delayed (do not confuse with posttraumatic rhinitis)
  - RHINORRHEA – salty taste in mouth.
  - point of external leakage is poor guide to site of fistula (e.g. CSF may enter ear but leave nose via Eustachian tube).
- **orthostatic headache**

## DIAGNOSIS

Differentiation from local bleeding without CSF leak:

- RING (HALO) TEST** - drop of nasal discharge is placed on piece of filter paper\* – CSF (less dense than blood) migrates further on paper than blood – CSF is seen as large transparent ring surrounding central blood clot.
 

\*but may be seen spontaneously on pillow
- pure bleeding usually **stops** in 1-2 days.

Differentiation from nasal secretions:

- CSF rhinorrhea is **clear fluid**, tends to be **profuse** (particularly when bending forward in morning)

- 2) **glucose concentration**: in CSF  $\geq 30$  mg/dl (in lacrimal secretions / nasal mucus  $< 5$  mg/dl); e.g. CSF tests positive for glucose using Dextrostix.
- 3) **chloride concentration**: CSF  $>$  lacrimal secretions / nasal mucus.
- 4)  **$\beta 2$ -transferrin assay** (present in CSF) - **most accurate diagnostic test** for CSF!
- 5) occult / intermittent CSF rhinorrhea – ENT may see **nasal mucosal maceration**.
- 6) injection of **radionuclide** (e.g.  $^{99m}\text{Tc}$  DTPA) into CSF  $\rightarrow$  tampons are placed in each nostril  $\rightarrow$  assessment of uptake by tampons - CSF rhinorrhea is diagnosed when tampon is impregnated with at least twice radioactivity of control tampon in opposite nostril (in presence of intact septum).

*Fistulės vietai nustatyti anksčiau buvo naudojamos dažo medžiagos į CSF (methylene blue\*, fluorescein, fenolsulfonftaleinas, indigokarminas), tačiau jos veikia toksiškai ir šiuo metu nebenaudojamos.*

\*may be lethal intrathecally!

**X-ray, CT bone window** – fluid in paranasal sinuses, skull fracture.

If there is CSF leak but *fracture site is not evident* (important before attempted surgical repair)  $\rightarrow$  at time when patient is actively leaking fluid, perform:

- a) **overpressure radionuclide cisternography (with  $^{99m}\text{Tc}$  DTPA)** - can demonstrate leak into nasal cavity or ear, but fails to delineate fistula site!

Radionuclide cisternogram - anterior fossa CSF fistula:



- b) **overpressure CT cisternography (with metrizamide)** - instillation (via LP) of water-soluble contrast into CSF  $\rightarrow$  temporarily occlude both jugular veins for 4-5 min to encourage active leakage  $\rightarrow$  **CT in coronal plane with patient placed prone\***  $\rightarrow$  contrast medium in sinuses or nasal cavity.

\*leaking is likely to be maximal in this position

N.B. site of intermittent leaks is rarely delineated, but most such leaks resolve spontaneously!

**MRI with intrathecal gadolinium** (CT is less sensitive – bone and intrathecal contrast look the same and obscure each other).

## COMPLICATIONS

- 1) poor wound healing
- 2) severe headaches (intracranial hypotension)
- 3) recurrent bacterial meningitis!!! (esp. *Streptococcus pneumoniae*)

**RHINORRHEA > OTORRHEA**

*Kai likvorėja išnyksta per 7 dienas meningito rizika – 11-20%, o tęsiantis ilgiau - net 88%.*

**PROPHYLAXIS**

- 1) **"oversew"** - sew stitches closer together in tissues immediately overlying surgical site.
- 2) **vascularized pericranial flaps** to repair holes in dura (e.g. temporalis muscle flaps, trapezius muscle flaps, free radial forearm flaps, free rectus abdominis muscle flaps).
- 3) **dural sealants** – see p. Op140 >>
- 4) **prophylactic temporary CSF diversion** (EVD, lumbar drain) – drain for 3 days, then clamp for 24 hrs (if no leak – D/C drain).

**TREATMENT**

1. Bed rest with **head elevation  $\geq 45^\circ$** , **avoid Valsalva** (laxatives); if CSF leak is lumbar – keep patient **flat**.  
N.B. leak may be only temporarily closed with brain and then recur!
2. **CSF production decreasing agents** (e.g. **ACETAZOLAMIDE**) - controversial
3. **Pressure dressing** (does not work for posterior fossa) and **wound resuturing** if CSF leaks externally (but CSF may find alternate means of egress, e.g. via rhinorrhea).
4. **Local antibiotics** (e.g. INTO EAR CANAL); prophylactic **systemic antibiotics** are started after 7<sup>th</sup> day of CSF leak (many cases arrest spontaneously within 7 days).

N.B. routine prophylactic antibiotics lead to selection of resistant organisms → drug-resistant meningitis.

If CSF leak still persists for > 12-48 hours → **reduce CSF pressure** by:

- a) **multiple lumbar punctures**\*
- b) continuous / intermittent drainage via **lumbar drain**\* (at the end, clamp drain for 24 hrs – if no leak, remove drain).
- c) **permanent diversion** by indwelling shunt (in case of coexisting hydrocephalus).

\*remove 50-400 mL in any given 24-hour period (e.g. 10 mL/h)

Progressive diminution of level of consciousness (during CSF drainage) - possibility of pneumocephalus!

**RHINORRHEA** is less likely (80%) to arrest spontaneously than **OTORRHEA** (95%)

Some surgeons observe drainage for 2 days, others use as many as two 5-day trials of continuous lumbar drainage; if unsuccessful → **operation**: craniotomy with reapproximation of torn dura, suturing fascia / pericranium / muscle autografts to reinforce closure.

- *skull base dura* is thin and difficult to repair (esp. dura overlying cribriform plate - olfactory nerves travel through it).

*Geriau yra užsiūti kietojo dangalo defektą **ekstraduraliai**, tačiau defektą lengviau surasti **intraduraliai**.*

If everything fails – place **VP shunt**.

- if there is no external CSF leak, may **observe** CSFomas (pseudomeningoceles) – many disappear over several months.

BIBLIOGRAPHY see p. S50 >>

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**Viktor's Notes<sup>SM</sup> for the Neurosurgery Resident**  
Please visit website at [www.NeurosurgeryResident.net](http://www.NeurosurgeryResident.net)